California Department of Water Resources
Oroville Facilities
Preliminary Issue Sheet

F3. Effects of Project on Resident Fish Habitat

Issue Statement: Project effects on resident fish species (e.g., trout and other salmonids and warm water fish) habitat quantity and quality (including instream flow, sediment, woody debris, water temperature, etc.) and habitat for other aquatic species.

Resource Goals:

- Minimize or mitigate adverse project related effects on the habitat of resident fish.

- Provide cold- and warm-water fisheries sufficient to support desired recreational and commercial (bait, crayfish, etc.) fisheries.

- Enhance habitat for resident aquatic species.

- Minimize impact of stocked resident and introduced fish~~species~~ on wild, anadromous salmonids.

Scope: Within the FERC project boundary waters ~~and the Feather River downstream to the Yuba River.~~ The ~~S~~study scope could also extend downstream to the mouth of the Feather River for some elements of this issue. The specific downstream scope will be defined for each element in the Study Plan.

Existing Information: ~~(segregate information for upstream and downstream)~~

FERC Project Boundary Waters

1. DWR Lake Oroville Annual Reports of Fish Stocking and Fish Habitat Enhancements to FERC, 1994-1999 - Lake Oroville fishery management information:
    a. Resident fish stocking data
    b. Resident fish species data
    c. Fish habitat enhancement projects
2. DWR Lake Oroville 90-Day Fishery Reports to FERC, 1995-1999 - Lake Oroville fishery management information:
    a. Resident fish species data
    b. Resident fish stocking data
    c. Fish habitat enhancement projects
    d. Temperature profiles

3. DWR Lake Oroville Fisheries Habitat Enhancement Plan, 1995 - Lake Oroville fish habitat and habitat enhancement information.
4. DWR Lake Oroville Fishery Management Plan Progress Report, October 1993 - Lake Oroville fishery information, tributary information.
5. DWR Amended Recreation Plan for Lake Oroville State Recreation Area, 1993 - Lake Oroville fishery information.
6. DWR project operations data, including surface elevations of project reservoirs and inflow/outflow data.
7. PG&E FERC relicensing proceedings and studies of North Fork Feather River projects - Including draft Poe Project License Application. Information on tributary (North Fork Feather River) fish.
8. Various DFG studies, management plans and activities, such as:
    a. An Evaluation of Fish Populations and Fisheries in the Post-Oroville Project Feather River, 1977
    b. DFG Inland Fisheries Division - Information Leaflet No. 42, Warm Water Reservoir Fish Habitat Improvement Guide
    c. DFG Annual Reports on Fish Habitat Enhancement
    d. Strategic Plan for Trout Management
9. Geomorphic information listed in G1 such as:
    a. 1993-1994 DWR Lake Oroville Siltation Study
10. Other historic literature related to fish habitat within the FERC project waters

Feather River Below Oroville Dam

1~~7~~. Abundance and emigration timing of juvenile salmon and steelhead since 1996. Data comes from DWR-ESO operation of rotary screw traps, fyke traps, and seining. Traps typically operated from December through June.

2~~8~~. Annual population estimates for fall and spring run salmon returning to spawn. Surveys conducted by DFG (using various methods) every Fall since 1954.

3~~9~~. Distribution and habitat use of juvenile salmon and steelhead. DWR-ESO study began in Spring of 1999, utilizes snorkeling observations. Surveys are conducted from March - August on the Feather River between the Fish Barrier Dam and Gridley Bridge.

~~1~~04. Survival and contribution rate of “wild” and hatchery produced salmon:
    a. DWR-ESO and DFG have been implanting coded wire tags in juvenile hatchery salmon since 1975. DWR-ESO began tagging “wild” juvenile salmon in 1998
    b. Tags are recovered through ocean and inland harvest recovery programs coordinated by DFG
    c. New analysis of tag recoveries underway through contract with SFSU Romberg Tiburon Center and USFWS

~~1~~15. Habitat surveys, habitat maps and gravel surveys:
    a. Depth, current velocity, substrate, in-stream cover, over-head cover are recorded as part of DWR-ESO steelhead and salmon habitat use studies in 1999 and 2000

b. Riffles, pools, glides and backwater habitats have been delineated on aerial photographs from the Fish Barrier Dam to the Gridley Bridge. This mapping was conducted by DWR-ESO as part of lower river fish studies in 1999, and with 1992 IFIM studies

c. DWR Northern District published Feather River gravel condition reports in 1982 and 1996

~~12~~6. Historic stream flows in the low flow channel and below Thermalito Afterbay outlet.

~~13~~7. Temperature data from the low flow channel and below Thermalito Afterbay outlet:

a. Hourly temperatures recorded at 20 sites between the Thermalito Diversion Dam and Live Oak by DWR-ESO. Began in 1997 but records are incomplete until 1999

b. USGS recorded temperatures at gage downstream from Oroville Dam, 1958 to 1992; continuous temperatures since 1995 by DWR

c. OFD has recorded mean daily water temperatures at the Feather River Hatchery since initiation of hatchery operations and Robinson Riffle since July 31, 2000

d. USGS has published records of maximum and minimum daily water temperatures at the Thermalito Afterbay Outlet from October 1968 through September of 1992. Since 1992, only mean daily water temperature data is available from OFD

e. River temperature model developed by UC Davis under contract with DWR-ESO in 2000

~~14~~8. DWR-ESO instream flow study from 1992. Thirty-two transects selected between the Fish Barrier Dam and Honcut Creek. Salmon, steelhead and American shad were the target species.

~~15~~9. Laboratory study on steelhead growth and thermal biology. Study conducted by UC Davis in 1999 under contract with DWR-ESO.

~~16~~10. Macro-invertebrate food base available for rearing salmon and steelhead. Study began in Fall 2000 and will continue for two years. Funded by DWR-ESO through contract with Chico State University.

~~17~~11. Stranding and redd dewatering study by DWR-ESO began in Fall 2000. Study will identify potential stranding areas between the Fish Barrier Dam and Honcut Creek, and attempt to quantify salmonid losses.

~~18~~12. Various DFG studies, management plans and activities, such as:

a. An Evaluation of Fish Populations and Fisheries in the Post-Oroville Project Feather River, 1977

~~b. DFG Inland Fisheries Division - Information Leaflet No. 42, Warm Water Reservoir Fish Habitat Improvement Guide~~

~~c. DFG Annual Reports on Fish Habitat Enhancement~~

b~~d~~. Strategic Plan for Trout Management

c. Feather River Hatchery Production Goals and Constraints (Operational Plans)

~~19~~13. Current DFG/NMFS assessment of hatchery impacts.

~~20~~14. DWR/DFG water temperature criteria for the Feather River Hatchery.

~~21~~15. National Marine Fisheries Service temperature criteria for the Feather River at Robinson Riffle (low flow channel) in the 2001 biological opinion.

~~22. PG&E FERC relicensing proceedings and studies of North Fork Feather River projects - Including draft Poe Project License Application. Information on tributary (North Fork Feather River) fish.~~

~~23~~16. Other historic literature related to fish habitat within the FERC project waters and the Feather River downstream to Yuba River.

~~24~~17. Geomorphic information listed in G1 such as:

~~a. 1993-1994 DWR Lake Oroville Siltation Study~~

~~b~~a. 1982 DWR Feather River Spawning Gravel Baseline Study

~~c~~b. 1967 USGS report, "Sediment Transport in the Feather River, Lake Oroville to Yuba City, California

~~25~~18. NMFS Habitat Conservation Plan with CDFG on striped bass stocking program.

Information Needed: **~~(segregate upstream and downstream information)~~**

FERC Project Boundary Waters

1. ~~1.~~ Development of conceptual model of reservoir fishery and project impacts and interaction with protected species.
2. Assessment of resident fishery resources and habitat in the FERC project waters ~~and Feather River downstream to the Yuba River~~ using field sampling and literature review:
   a. Identification of resident fish
   b. Life history characteristics related to fish habitat
2. Identification of resident fish habitat types.
3. Reservoir ~~Surface~~ surface fluctuation model results in different water year types, and affect on habitat availability and condition.

~~4. Feather River flow model results in different water year types.~~

5. Temperature model~~ings~~ results of project waters, and project affected waters (also listed in W3, W13).

~~6. Preliminary instream flow study designed to evaluate channel changes since 1992 IFIM study and to specifically address flow effects on resident rainbow trout.~~

7. Literature review and analyses listed in G1 related to resident fish habitat.
8. ~~Evaluation of stocked resident and introduced species on wild anadromous salmonids.~~

Feather River Below Oroville Dam

1. Development of conceptual model of Feather River resident fishery and project impacts and interaction with protected species.
2. Assessment of resident fishery resources and habitat in the Feather River using field sampling and literature review:
   a. Identification of resident fish
   b. Life history characteristics related to fish habitat
3. Identification of resident fish habitat types.

4. Feather River flow model results in different water year types.
5. Temperature modeling results of project waters, and project affected waters (also listed in W3, W13).
6. Preliminary instream flow study designed to evaluate channel changes since 1992 IFIM study and to specifically address flow effects on resident rainbow trout.
7. Evaluation of stocked resident and introduced species on wild anadromous salmonids.

Level of Analysis:

Site specific field assessment of resident fishery resources and fish habitat, and desktop study of resident fish habitat and how it may be affected by the project.

Issues Addressed by Issue Statement:

FE9 Use Instream Flow Incremental Methodology (IFIM) or a comparable methodology to determine streamflow needs to ensure that trout habitat quality and quantity are not reduced within project area and/or project affected areas;

FE12 Protect and improve wild trout habitat;

FE13 Require proponents to coordinate with Plumas National Forest (PNF) in analysis of instream flow need for all potentially affected riparian dependent species;

FE59 Protect and improve habitat for trout;

FE64 Effect of project on available upstream fishery habitat (Incorporate all project facilities);

FE78 Quality and extent of habitat above currently impassable barriers to migration;

FE81 Currently some of the species of fish commonly found in Lake Oroville are also found in the Poe reach of the North Fork Feather River. Maximum water temperatures in the Poe reach often exceed 20 C (68 F), making management of the Poe reach as a coldwater fishery difficult. There is an interest in determining the interaction of the Lake Oroville fishery with the Poe reach fishery, and identifying measures that can be taken to maintain the Poe reach as a coldwater fishery;

FE84 Evaluate indicators of hydrological alteration (IHA analysis);

FE95 The lower Feather River provides habitat to support a variety of anadromous fish species including Chinook salmon, steelhead, striped bass, American shad and sturgeon. Potential changes in license conditions could adversely impact habitat supporting these species. Habitat investigations should evaluate the existing quality and quantity of habitat and determine alternative improvements for the various life history needs of anadromous species including flow, water temperature, instream and riparian cover, substrate and spatial area;

FE96 The lower Feather River provides habitat to support a variety of resident native and resident introduced species including coldwater species such as rainbow, brook, and brown trout, and warm water species such as bass, catfish, bluegill, green sunfish, carp and others. Potential changes in license conditions could adversely impact habitat supporting these species or upset habitat conditions such that less desirable species are favored. Habitat investigations should evaluate the existing quality and quantity of habitat and determine alternative improvements for the various life history needs of these resident native and non-native species including flow, water temperature, instream and riparian cover, substrate and spatial area;

FE97 The habitat for fishes in the lower Feather River is affected by the flow releases from the project. Seasonal timing, volume, and rate of release all have an affect on fish habitat conditions. Potential changes in license conditions for flow releases could adversely affect habitat conditions for one or more fish species. Fishery investigations should examine the adequacy of flows for maintaining all life history needs for anadromous and resident species. There should be evaluation of potential for flow improvements in the low-flow section. Fishery investigations should be sufficient to determine how best to meet the combined needs of the various anadromous and resident fish species;

W9 Effects of existing and future project facilities and operations on thermal stratification and other thermal processes on project waters, including availability of cold water for release in various water year types under current and future operational demands.

G1 Effects of existing and future project operations on natural geomorphic processes. These include physical attributes and functions (e.g., channel morphology, channel stability, sediment transport and deposition, spawning gravel and large woody debris recruitment, habitat diversity) and subsequent effects on biological resources (e.g., aquatic macroinvertebrates, riparian vegetation) in the low-flow section and in the Feather River downstream of Thermalito Afterbay under wet and dry year criteria.

GE3 Alterations in stream hydrology affect the natural fluvial geomorphologic processes of a riverine system. How has the change in magnitude, frequency and timing of peak flows and rates of flow change on the Feather River affected riparian vegetation recruitment in the low-flow reach and immediately downstream of the Afterbay, under wet and dry year criteria;

GE4 Under existing conditions, are bankfull flows frequent enough to maintain channel morphology, sediment transport, habitat diversity and adequate gravels for salmonid spawning and rearing in the low-flow section and in the river downstream of Thermalito Afterbay;

GE5 Under existing conditions, are the moderate winter floods and bankfull flows adequately recruiting the amount of large woody debris needed to

maintain adequate salmonid rearing habitat in the low-flow section and in the river downstream of Thermalito Afterbay;

GE20 Indicators of hydrological alteration (IHA analysis);

GE23 Releases that reflect nature cycles benefit biological cycles – how have changes in seasonal release patterns affected fish, invertebrates, and their habitat;

GE25 Natural geomorphological processes historically occurred within the Feather River watershed and are the result of geologic and hydrologic processes such as weathering, erosion, runoff patterns, material transport and deposition. Project features and operations have altered these natural geomorphic processes. Alteration of these geomorphic processes has affected the riverine habitat and species that depend on it. The FWS is concerned that project operations may have taken us beyond some critical thresholds for ecosystem sustainability. We are concerned that maintenance of a satisfactory abiotic template (e.g., substrate used for invertebrate production and fish spawning) is not occurring). The FWS wants assurance that new license conditions will allow for minimum thresholds of geomorphic processes to take place thus ensuring sufficient natural sediment movement and a satisfactory abiotic habitat template are in place;

WE46 Spawning habitat in tributaries as they relate to operations.

Environmental Workgroup
Oroville Facilities Relicensing
Preliminary Issue Sheet

F6. Sediment

Issue Statement: Effects of existing and future project operations on sediment deposition, erosion, and recruitment through the system (including downstream sediment supply) and associated changes in water quality on the quantity and quality of aquatic habitats within project affected waters.

Resource Goals:

- Minimize and mitigate project impacts ~~which~~ that harm aquatic habitats by altering geomorphic processes or degrading water quality.

- Enhance aquatic habitats through alteration of geomorphic processes.

Scope: Within the FERC project ~~boundaries~~ boundary ~~and the Feather River downstream to Honcut Creek~~the confluence with the Yuba RIver. The ~~S~~study scope could extend downstream to the mouth of the Feather River for some elements of this issue. The specific downstream scope will be defined for each element in the Study Plan.

Existing Information:

1. Habitat surveys, habitat maps and gravel surveys.
    a. Depth, current velocity, substrate, in-stream cover, over-head cover are recorded as part of DWR-ESO steelhead and salmon habitat use studies in 1999 and 2000.
    b. Riffles, pools, glides and backwater habitats have been delineated on aerial photographs from the Fish Barrier Dam to the Gridley Bridge. This mapping was conducted by DWR-ESO as part of lower river fish studies in 1999, and with 1992 IFIM studies.
    c. DWR Northern District published Feather River gravel condition reports in 1982 and 1996.
2. Historic stream flows in the low flow channel and below Thermalito Afterbay outlet.
3. Materials identified in Issue Sheet G1 (“Feather River spawning gravel baseline study”; “Use of alternative gravel sources for fishery restoration”) and W3 (“Initial Information Package”).

Information Needed:

1. Materials identified in Issue Sheet G1 (Items 1 through 4) and W3 (Items 1c and 3).
2. Item ~~14~~ (correct number after F-1, Batch 3 is completed) from Issue F1; specifically, an estimate of the change in amount of spawning and rearing habitat for salmonids due to project operations.
3. Proposed recreation development from relicensing effort.
4. Results from Index of Hydrologic Alteration (IHA) analysis (G5)
5. Anticipated future flow conditions (modeling results – see G5)
6. Assessment of sediment deposition and erosion on reservoir and riverine aquatic habitats.

Level of Analysis:

Preliminary investigation will rely on the existing and ~~ongoing~~ new studies conducted for Geological and Water Quality issues. The evaluation will focus on habitat linkages. These studies will be augmented, as needed, with literature review and focused field studies.

Issues Addressed by Issue Statement:

FE24 Evaluate potential to restore Ruddy Creek;

FE89 Impact of project structures and operations on water quality conditions necessary to sustain anadromous salmonids and their habitats;

FE95 The lower Feather River provides habitat to support a variety of anadromous fish species including Chinook salmon, steelhead, striped bass, American shad and sturgeon. Potential changes in license conditions could adversely impact habitat supporting these species. Habitat investigations should evaluate the existing quality and quantity of habitat and determine alternative improvements for the various life history needs of anadromous species including flow, water temperature, instream and riparian cover, substrate and spatial area;

FE96 The lower Feather River provides habitat to support a variety of resident native and resident introduced species including coldwater species such as rainbow, brook, and brown trout, and warm water species such as bass, catfish, bluegill, green sunfish, carp and others. Potential changes in license conditions could adversely impact habitat supporting these species or upset habitat conditions such that less desirable species are favored. Habitat investigations should evaluate the existing quality and quantity of habitat and determine alternative improvements for the various life history needs of these resident native and non-native species including flow, water temperature, instream and riparian cover, substrate and spatial area;

G1 Effects of existing and future project operations on natural geomorphic processes. These include physical attributes and functions (e.g., channel morphology, channel stability, sediment transport and deposition, spawning gravel and large woody debris recruitment, habitat

diversity) and subsequent effects on biological resources (e.g., aquatic macroinvertebrates, riparian vegetation) in the low-flow section and in the Feather River downstream of Thermalito Afterbay under wet and dry year criteria;

GE2 Project features and operations alter the hydrology of the system, creating the possibility for scour zones within both natural and designed channels. What effects do discharge and ramping rates have on substrate scour and the mobilization of sediments into the water column downstream;

GE4 Under existing conditions, are bankfull flows frequent enough to maintain channel morphology, sediment transport, habitat diversity and adequate gravels for salmonid spawning and rearing in the low-flow section and in the river downstream of Thermalito Afterbay;

GE9 Channel morphology and changes from operation – armoring spawning habitat and lateral erosion of banks;

GE10 Has the project resulted in sediment starvation (e.g., reduced gravel recruitment) to the lower river, and if so, by how much;

GE19 Gravel recruitment impacts of the dam – both up and down stream;

GE24 Direct, indirect, and cumulative impacts of project facilities and operations on sediment movement and deposition, river geometry, and channel characteristics. This includes impacts on stream competence, capacity, bank stability and extend, duration, and repetition of high flow events;

GE25 Natural geomorphological processes historically occurred within the Feather River watershed and are the result of geologic and hydrologic processes such as weathering, erosion, runoff patterns, material transport and deposition. Project features and operations have altered these natural geomorphic processes. Alteration of these geomorphic processes has affected the riverine habitat and species that depend on it. The FWS is concerned that project operations may have taken us beyond some critical thresholds for ecosystem sustainability. We are concerned that maintenance of a satisfactory abiotic template (e.g., substrate used for invertebrate production and fish spawning) is not occurring). The FWS wants assurance that new license conditions will allow for minimum thresholds of geomorphic processes to take place thus ensuring sufficient natural sediment movement and a satisfactory abiotic habitat template are in place;

W3 Effects of existing and future project operations on the physical, chemical and biological components of water quality of the Feather River, affected tributaries and downstream waters. The project has the potential for direct and indirect effects on aquatic ecosystem health, on recreational opportunity, and on domestic and agricultural water supply;

W6 Effect of existing and future project facilities and operations on sediment deposition and potential impoundment of metals and toxins, including the potential presence and uptake of methyl mercury through the food chain. Lake Oroville, fed by tributaries that have a history of gold mining

activity, has potential for accumulation of elemental mercury in its basin sediments.

California Department of Water Resources
Oroville Facilities
Preliminary Issue Sheet

F7. Effects of Project on Lake and Tributary Fish Interactions

Issue Statement: Project effects on interactions, including predation and competition, among lake and tributary fish population (e.g. land-locked chinook salmon, trout, bass, and other land-locked species) that affect species abundance, growth, reproduction, and survival.

Resource Goals:

- Minimize and mitigate adverse project effects on interactions between lake and tributary fish populations.

- Enhance tributary and lake fisheries.

Scope: Within the FERC project boundary waters and the tributaries upstream to the current upper migratory limit.

Existing Information:

1. DWR Lake Oroville Annual Reports of Fish Stocking and Fish Habitat Enhancements to FERC, 1994-1999 - Lake Oroville fishery management information:
    a. Resident fish stocking data
    b. Resident fish species data
    c. Fish habitat enhancement projects
2. DWR Lake Oroville 90-Day Fishery Reports to FERC, 1995-1999 - Lake Oroville fishery management information:
    a. Resident fish species data
    b. Resident fish stocking data
    c. Fish habitat enhancement projects
    d. Temperature profiles
3. DWR Lake Oroville Fisheries Habitat Enhancement Plan, 1995 - Lake Oroville fish habitat and habitat enhancement information.
4. DWR Lake Oroville Fishery Management Plan Progress Report, October 1993 - Lake Oroville fishery information, tributary information.
5. DWR letters to FERC (4/16/01 & 7/13/00) - updates to FERC regarding IHN and its impact on Lake Oroville fishery management.
6. California Department of Fish and Game (DFG) sponsored IHN resistance study at University of California, Davis - preliminary reports:

a. Various salmon and trout strains investigated, including coho and kokanee salmon, lake trout, brook trout, brown trout, rainbow trout-Pit River strain, coastal and Lahontan cutthroat trout

7. DFG Fish Health Lab reports on IHN at Feather River Hatchery - prepared periodically during the year, particularly during the fall spawning season.
8. Miscellaneous DFG Fish Health Lab reports - various fish diseases (both warm and cold water) that occur periodically in project waters, as well as other similar California waters.
9. Miscellaneous publications on fish diseases - from State and federal fish and wildlife agencies, and other appropriate sources, such as:
    a. DFG Fish Bulletins
    b. U.S. Fish and Wildlife Service publications
    c. State of Washington, Department of Fisheries, Hatchery Division
    d. Utah Division of Wildlife Resources
10. DWR Amended Recreation Plan for Lake Oroville State Recreation Area, 1993 - Lake Oroville fishery information.
11. DWR project operations data, including surface elevations of project reservoirs and inflow/outflow data.
12. Various DFG studies, management plans and activities, such as:
    a. An Evaluation of Fish Populations and Fisheries in the Post-Oroville Project Feather River, 1977
    b. DFG Inland Fisheries Division - Information Leaflet No. 42, Warm Water Reservoir Fish Habitat Improvement Guide
    c. DFG annual reports on fish habitat enhancement
    d. Strategic Plan for Trout Management
13. Pacific Gas and Electric Company FERC relicensing proceedings and studies of North Fork Feather River projects - including draft Poe Project License Application. Information on tributary (North Fork Feather River) habitat and fish.

Information Needed:

1. Assessment of lake and tributary fishery resources using field sampling and literature review:
    a. Identification of lake and tributary fish species
    b. Life history characteristics related to fish species interactions such as fish disease, predation, competition for food and space, and hybridization
2. Identification of upper migratory limit through field assessment and literature review.
3. Identification of resident fish habitat types using field sampling and literature review.
4. Reservoir ~~Surface~~ surface fluctuation model results in different water year types, and affect on habitat availability.
5. Identification of project effects on lake and tributary fish interaction, such as:
    a. Water level fluctuation affecting fish migration and exposure of barriers

b. Sediment transport and deposition affecting fish migration
c. Project related fish stocking - species stocked, size, amount, location, disease concerns, etc.

6. Flow ~~model~~ of Feather River tributaries in different water year types (W3).
7. Temperature modeling results~~s~~ of project waters, and collected temperature data for tributaries to upper migratory limit (W3).
8. DFG sponsored IHN resistance study at University of California, Davis, and Feather River Hatchery - Final Report (study is currently underway):
    a. Various salmon and trout strains investigated, including coho and kokanee salmon, lake trout, brook trout, brown trout, rainbow trout - Pit River strain, coastal and Lahontan cutthroat trout
9. DFG - IHN evaluation (field sampling and laboratory analysis) in Diversion Pool/Forebay, lower Feather River and selected Lake Oroville tributary waters.
10. Literature review of other (non-IHN) fish disease outbreaks within the project waters and project-affected waters. Review DFG fish health lab reports, Feather River Hatchery reports, DFG Administrative Reports and other records. This review will identify the documented disease outbreaks in these waters, the life history characteristics of these diseases, the outbreak timing and duration, the mechanism of disease transmission, control methods, and, if possible, will determine whether the project affected the establishment, extent, and control of these disease outbreaks.

Level of Analysis:

Field assessment of lake and tributary fishery resources, and desktop study of how project may be affecting lake and tributary fish interactions.

Issues Addressed by Issue Statement:

FE25 Interaction of lake fishery with tributaries fisheries;
FE27 Land-locked salmon fishery;
FE52 Facility operations and impact – on bass fishery and spawning activities at afterbay (protect and enhance bass fishery);
FE59 Protect and improve habitat for trout;
FE66 Expand land-lock fishery to include all salmon not just Chinook;
FE79 Oroville Reservoir provides substantial recreational fishing opportunity for both black bass and Chinook salmon fisheries. Hatchery planting practices for Chinook salmon could be impacting habitat conditions and the population dynamics of black bass and other species, thus impairing socioeconomic use. Fishing interests want to improve the reservoir fishery so that it becomes a more popular recreational destination as a result of a successful balanced species reservoir fishery. An appropriate balance of species should exist in the reservoir to support environmental sustainability and long-term maintenance of a healthy ecosystem;
FE81 Currently some of the species of fish commonly found in Lake Oroville are also found in the Poe reach of the North Fork Feather River.

Maximum water temperatures in the Poe reach often exceed 20 C (68 F), making management of the Poe reach as a coldwater fishery difficult. There is an interest in determining the interaction of the Lake Oroville fishery with the Poe reach fishery, and identifying measures that can be taken to maintain the Poe reach as a coldwater fishery;

FE100 Create more habitat for the black bass and warm water fishes such as spawning beds or boxes; spawning plates or stationary buoy cables.

Environmental Workgroup
Oroville Facilities Relicensing
Preliminary Issue Sheet

F9. Hatchery Effects

Issue Statement: Hatchery effects (e.g. straying, genetic impacts, harvest rates, disease, temperature requirements) on salmonid populations in the Feather River watershed and other Central Valley tributaries and on ecosystem restoration within project waters and project affected waters.

Resource Goals:

- Minimize and mitigate hatchery impacts on naturally produced salmonids.
- Provide populations of anadromous fish sufficient to support ~~desired~~ recreational and commercial fisheries.
- Continued mitigation for loss of anadromous fish spawning habitat in the Feather River

Scope: ~~Studies would extend from~~Feather River Hatchery and Feather River from the Fish Barrier Dam, through the low flow channel and downstream to Honcut Creek. Analysis based on recovery of coded wire tags, and/or existing information would include other areas in the Central Valley and ocean for which data are available.

Existing Information:

1. Annual population estimates for fall and spring run salmon returning to spawn. Surveys conducted by DFG (using various methods) every Fall since 1954.
2. Abundance and emigration timing of juvenile salmon and steelhead since 1996. Data comes from DWR-ESO operation of rotary screw traps, fyke traps, and seining. Traps typically operated from December through June.
3. Distribution and habitat use of juvenile salmon and steelhead. DWR-ESO study began in Spring of 1999, utilizes snorkeling observations. Surveys are conducted from March - August on the Feather River between the Fish Barrier Dam and Gridley Bridge.
4. Survival, contribution and harvest rates of “wild” and hatchery produced salmon.
    a. DWR-ESO and DFG have been implanting coded wire tags in juvenile hatchery salmon since 1975. DWR-ESO began tagging “wild” juvenile salmon in 1998.

b. Tags are recovered through ocean and inland harvest recovery programs coordinated by DFG.
c. New analysis of tag recoveries underway through contract with SFSU Romberg Tiburon Center and USFWS. This study will determine straying rates, harvest levels and relative contribution of wild and hatchery salmon.

5. Genetic characterization of Central Valley chinook salmon at UC Davis, funded by DWR-ESO. Studies analyze Feather River hatchery spring run and fall run and will determine their relationship to other Central Valley populations.
6. Temperature data from the low flow channel and below Thermalito Afterbay outlet
    a. Hourly temperatures recorded at 20 sites between the Thermalito Diversion Dam and Live Oak by DWR-ESO. Began in 1997 but records are incomplete until 1999.
    b. USGS recorded temperatures at gauge downstream from Oroville Dam, 1958 to 1992, continuous temperatures since 1995 by DWR.
    c. OFD has recorded mean daily water temperatures at the Feather River Hatchery since initiation of hatchery operations and Robinson Riffle since July 31, 2000.
    d. USGS has published records of maximum and minimum daily water temperatures at the Thermalito Afterbay Outlet from October 1968 through September of 1992. Since 1992, only mean daily water temperature is available from OFD.
7. River temperature model results developed by UC Davis under contract with DWR-ESO in 2000
8. Laboratory study on steelhead growth and thermal biology. Study conducted by UC Davis in 1999 under contract with DWR-ESO.
9. Macro-invertebrate food base available for rearing salmon and steelhead. Study began in Fall 2000 and will continue for two years. Funded by DWR-ESO through contract with Chico State University.
10. NMFS evaluation of Feather River Hatchery.
11. DFG policies and procedures for Feather River Hatchery.
12. DFG/DWR water temperature criteria for Feather River Hatchery.

Information Needed:

1. Items 7, 8, 9, 10, 11 and 12 from issue F1.
2. Genetic study of Feather River steelhead to determine relatedness to other Central Valley stocks, and to test for hybridization of hatchery and wild steelhead.
3. Water quality effects of discharge (e.g., nutrients, chemical treatments) from Feather River Hatchery on wild salmonids in the Feather River. (Water Quality Issue Sheet 11 info)
4. Water quality impacts (e.g. low dissolved oxygen, nutrient loading) of large spawning runs of hatchery salmon on stream health and wild fish production.

5. Desktop study on the effects of crowding and redd superimposition associated with large runs of hatchery salmon on the success of in-river spawning salmonids, particularly spring-run salmon and steelhead.
6. Continuation and/or modification of studies listed in existing information, specifically item numbers 1, 3, 4, 6a, and 9.

Level of Analysis:

Because much information exists, analysis will rely on the literature and ongoing studies, augmented as needed with studies identified above to assess hatchery effects on salmonids. Studies of wild juvenile salmonids will focus on spring and summer, when this life stage is most abundant and susceptible to unfavorable water temperatures, flows, disease and interactions with hatchery-released fish. Studies of spawning conditions would take place in the fall. Studies related to hatchery effluent water quality would take place year-round, but would focus on winter and spring, when the hatchery is at peak production.

Issues Addressed by Issue Statement:

FE31 Several fish hatchery issues need resolution, such as the relationship between the hatchery and restoration of a natural ecosystem, straying and genetic impacts, harvest rates, and disease;

FE87 Introgression occurring between various runs of Chinook salmon and between hatchery and wild salmon and steelhead. This includes direct, indirect and cumulative impacts from hatchery practices, project facilities and operations, lack of adequate spawning habitat and impassable migration barriers that exclude access to historic spawning habitats;

FE88 Impact of hatchery facilities and/or operations on anadromous salmonids. This includes the direct, indirect and cumulative impacts of hatchery product on anadromous salmonids and the direct, indirect and cumulative impacts of hatchery facilities and operations on salmonids and their habitats;

FE93 Introgression occurring between fall-run and spring-run Chinook populations in the Feather River due to hatchery practices and impassable migration barriers;

FE95 The lower Feather River provides habitat to support a variety of anadromous fish species including Chinook salmon, steelhead, striped bass, American shad and sturgeon. Potential changes in license conditions could adversely impact habitat supporting these species. Habitat investigations should evaluate the existing quality and quantity of habitat and determine alternative improvements for the various life history needs of anadromous species including flow, water temperature, instream and riparian cover, substrate and spatial area;

FE96 The lower Feather River provides habitat to support a variety of resident native and resident introduced species including coldwater species such as rainbow, brook, and brown trout, and warm water species such as bass, catfish, bluegill, green sunfish, carp and others. Potential changes in license conditions could adversely impact habitat supporting these species or upset habitat conditions such that less desirable species are favored. Habitat investigations should evaluate the existing quality and quantity of habitat and determine alternative improvements for the various life history needs of these resident native and non-native species

including flow, water temperature, instream and riparian cover, substrate and spatial area;

FE99 The Feather River Hatchery was constructed to mitigate for losses of upstream habitat when the Oroville facilities were constructed. There is a body of evidence suggesting that improperly planned hatchery practices can adversely impact native and non-native species including anadromous species. The effects of hatchery practices on naturally reproducing/self-sustaining anadromous populations should be examined as part of the fishery investigations. These evaluations should examine alternative practices that would lead to increased naturally reproducing/self-sustaining anadromous populations. Improper hatchery practices can also lead to transmission of serious fish diseases, and impact overall susceptibility of naturally reproducing populations to diseases;

W13 Effects of existing and future hatchery operations on water quality and water temperatures in the Feather River and Afterbay;

WE33 Relationship between hatchery and water quality.

Oroville Facilities Relicensing
Environmental Work Group
Preliminary Issue Sheet

W1. Project Effects on Designated Beneficial Uses

Issue Statement: Effects of existing and future project operations and facilities on all designated beneficial uses of the water. The beneficial uses for the Feather River watershed as defined in the Basin Plan include municipal and domestic supply, agriculture, electrical power production, contact and non-contact recreation, warm-water and cold-water fish spawning, rearing and migration, freshwater habitat, and wildlife habitat.

Resource Goals:

- Minimize and mitigate adverse project effects on water quality ~~and~~ to protect all beneficial uses.

- Ensure project related activities maintain or improve water quality to protect beneficial uses and meet or exceed State and other applicable objectives, goals, and criteria.

Scope: ~~Within the FERC project boundary and as appropriate outside of project boundary for project related effects in the Feather River downstream to the Yuba River.~~ Within the FERC boundary. The s~~S~~tudy scope could also extend downstream to the mouth of the Feather River for some elements of this issue. The specific downstream scope will be defined for each element in the Study Plan.

Existing Information:

1. Water Quality Control Plan (Basin Plan) for the Central Valley - designates beneficial uses
2. Initial Information Package - identifies and analyzes existing water quality information and project operation.

Information Needed:

1. Analyses of existing data and collection and analyses of additional data to determine effects of the project on the physical, chemical and biological components of water quality of the Feather River, affected tributaries and downstream waters (from W3).
2. ~~Any foreseen~~Identification of future modifications of project operations.
3. Evaluation of ~~water quality constituents and characteristics from~~chemical constituents, physical parameters and biological health of project waters to determine compliance with water quality objectives necessary for protection of designated beneficial uses (from W2).

Level of Analysis:

Review existing information, collect additional data where needed, and evaluate information to determine project compliance with quality objectives and effects on designated beneficial uses.

Issues Addressed by Issue Statement:

WE1 Look at project effects on all designated beneficial uses of the waterway;
WE10 Maintain or improve water quality to protect beneficial uses and meet or exceed State objectives;
WE19 Is the availability of a cold-water pool in Lake Oroville adequate under present and future operational demands to meet the existing downstream cold fresh-water habitat requirements of steelhead and fall, late-fall, and spring-run Chinook salmon;
WE24 Warm water release requirements for agricultural production;
WE25 Does the present temperature model have the ability to forecast average daily water temperatures, under present and future operational demands, in the low-flow channel and in the river from the Thermalito Afterbay outlet down to Verona;
WE30 Are dissolved oxygen levels in the Feather River from Thermalito Afterbay to Live Oak a problem during the spring, summer, and fall months;
WE31 How have turbidity levels been affected by project operation;
WE32 Thermalito Afterbay acts as a thermal retention basin for project water prior to delivery to water districts outside the project boundary. How do releases from this water body affect the stream temperature and dissolved oxygen content of Feather River receiving waters;
WE36 Both cold-water and warm-water habitat, spawning, and migration uses have been designated for surface waters potentially affected by the project. A determination must be made as to the specific thermal habitat that may be reasonably provided in each water body within project boundaries and downstream of the project;
WE37 Dredging of lower river to make suitable fish habitat;
WE40 Minimum level of draw-down effect on water temps;
WE46 Spawning habitat in tributaries as they relate to operations;
WE47 Effects of lake level changes on cultural resources due to water quality contaminants;
WE48 Macroinvertebrates as an indicator of water quality;
WE50 Conversion from lotic to lentic environment and accompanying changes in water quality;
WE54 Impact of project structures and operations on water quality conditions necessary to sustain anadromous salmonids and their habitat. Adequacy of current project operating regimes and structures to optimize water quality conditions for anadromous salmonids and their habitats;
F1 Effects of existing and future project operations (including power generation, water storage, ramping rates, and releases, pump-back, water levels, and

water level fluctuations) during all water year types on the behavior (e.g., migration timing, microhabitat selection, vulnerability to predators), reproduction, survival and habitat of warm- and cold-water fish and other aquatic resources (e.g., macroinvertebrates), which include in project waters and tributaries within the project boundaries (Lake Oroville, Diversion Pool, Fish Barrier Pool, Forebay, Afterbay, Oroville Wildlife Area), and in project affected waters;

FE36 Under existing conditions, does the diversity and abundance of benthic macroinvertebrates in the low-flow section and in the river downstream of Thermalito Afterbay suggest a healthy stream channel;

FE83 Macroinvertebrates as an indicator of water quality;

FE89 Impact of project structures and operations on water quality conditions necessary to sustain anadromous salmonids and their habitats;

FE96 The lower Feather River provides habitat to support a variety of resident native and resident introduced species including coldwater species such as rainbow, brook, and brown trout, and warm water species such as bass, catfish, bluegill, green sunfish, carp and others. Potential changes in license conditions could adversely impact habitat supporting these species or upset habitat conditions such that less desirable species are favored. Habitat investigations should evaluate the existing quality and quantity of habitat and determine alternative improvements for the various life history needs of these resident native and non-native species including flow, water temperature, instream and riparian cover, substrate and spatial area;

FE97 The habitat for fishes in the lower Feather River is affected by the flow releases from the project. Seasonal timing, volume, and rate of release all have an affect on fish habitat conditions. Potential changes in license conditions for flow releases could adversely affect habitat conditions for one or more fish species. Fishery investigations should examine the adequacy of flows for maintaining all life history needs for anadromous and resident species. There should be evaluation of potential for flow improvements in the low-flow section. Fishery investigations should be sufficient to determine how best to meet the combined needs of the various anadromous and resident fish species.

Oroville Facilities Relicensing
Environmental Work Group
Preliminary Issue Sheet

W2. Project Effects on Water Quality Objectives

Issue Statement: Effects of existing and future project operations on compliance with water quality objectives identified in the Regional Water Quality Control Board (RWQCB) Basin Plan. Specific compliance issues include bacteria, chemical constituents, dissolved oxygen, pH, oil and grease, pesticides, sediment, temperature, toxicity, and turbidity.

Resource Goals:

- Minimize and mitigate adverse project effects on water quality
- Ensure that water quality factors controllable by the project ~~in the project area~~ comply with Basin Plan objectives

Scope: Within the FERC boundary. The ~~S~~study scope could also extend downstream to the mouth of the Feather River for some elements of this issue. The specific downstream scope will be defined for each element in the Study Plan.
~~Within the FERC project boundary and as appropriate outside of project boundary for project related effects in the Feather River downstream to the Yuba River.~~

Existing Information:

1. Water Quality Control Plan (Basin Plan) for the Central Valley - designates beneficial uses and specifies water quality objectives
2. Initial Information Package - identifies and analyzes existing water quality information and project operation.

Information Needed:

1. Water quality constituents and characteristics for project waters (from W3, W4, W5, and W7).
2. Any foreseen future modifications of project operations.
3. Evaluation of existing and additional information collected to determine compliance with water quality objectives.

Level of Analysis:

Review existing information, collect additional data where needed, and evaluate information to determine project compliance with quality objectives.

Issues Addressed by Issue Statement:

WE2 Water quality objectives, including levels for bacteria, chemical constituents, dissolved oxygen, pH, oil and grease, pesticides, sediment, temperature, toxicity, and turbidity will be evaluated for compliance with the Basin Plan standards;

WE4 Specific issues will need to be addressed for the issuance of 401 Certification and for disclosure in the Applicant Prepared Environmental Assessment;

WE10 Maintain or improve water quality to protect beneficial uses and meet or exceed State objectives;

WE25 Does the present temperature model have the ability to forecast average daily water temperatures, under present and future operational demands, in the low-flow channel and in the river from the Thermalito Afterbay outlet down to Verona;

WE30 Are dissolved oxygen levels in the Feather River from Thermalito Afterbay to Live Oak a problem during the spring, summer, and fall months;

WE31 How have turbidity levels been affected by project operation;

WE32 Thermalito Afterbay acts as a thermal retention basin for project water prior to delivery to water districts outside the project boundary. How do releases from this water body affect the stream temperature and dissolved oxygen content of Feather River receiving waters;

WE36 Both cold-water and warm-water habitat, spawning, and migration uses have been designated for surface waters potentially affected by the project. A determination must be made as to the specific thermal habitat that may be reasonably provided in each water body within project boundaries and downstream of the project;

WE40 Minimum level of draw-down effect on water temps;

WE48 Macroinvertebrates as an indicator of water quality;

WE50 Conversion from lotic to lentic environment and accompanying changes in water quality;

WE53 Consider water quality downstream of Oroville facilities and the effect of low flows on dilution of contaminants entering the Feather River downstream;

WE54 Impact of project structures and operations on water quality conditions necessary to sustain anadromous salmonids and their habitat. Adequacy of current project operating regimes and structures to optimize waterquality conditions for anadromous salmonids and their habitats;

F1 Effects of existing and future project operations (including power generation, water storage, ramping rates, and releases, pump-back, water levels, and water level fluctuations) during all water year types on the behavior (e.g., migration timing, microhabitat selection, vulnerability to predators), reproduction, survival and habitat of warm- and cold-water fish and other aquatic resources (e.g., macroinvertebrates), which include in project waters and tributaries within the project boundaries (Lake Oroville, Diversion Pool, Fish Barrier Pool, Forebay, Afterbay, Oroville Wildlife Area), and in project affected waters.

Oroville Facilities Relicensing
Environmental Work Group
Preliminary Issue Sheet

W3. Project Effects on Feather River and Tributaries

Issue Statement: Effects existing and future project operations on the physical, chemical and biological components of water quality of the Feather River, affected tributaries and downstream waters. The project has the potential for direct and indirect effects on aquatic ecosystem health, on recreational opportunity, and on domestic and agricultural water supply.

Resource Goals:

- Minimize and mitigate adverse project effects on the physical, chemical, and biological integrity of water in Oroville Reservoir, its tributaries, and the Feather River.

- Ensure factors controllable by the project sustain the physical, chemical, and biological integrity of water in Oroville Reservoir, its tributaries, and the Feather River.

Scope: Within the FERC boundary. The ~~S~~study scope could also extend downstream to the mouth of the Feather River for some elements of this issue. The specific downstream scope will be defined for each element in the Study Plan.
~~Within the FERC project boundary and as appropriate outside of project boundary to the Yuba River for project related effects.~~

Existing Information:

1. Goals and criteria
    a. Water Quality Control Plan (Basin Plan) for the Central Valley - designates beneficial uses and specifies water quality objectives
    b. California Toxics Rule - specifies criteria for protection of aquatic life
    c. U.S. EPA National Toxics Rule - specifies criteria for protection of aquatic life
    d. U.S. EPA Nutrient Guidance Documents - recommends nutrient criteria for adoption by states
    e. U.S. EPA Title 40, Code of Federal Regulations, Parts 141 (primary MCLs) and 143 (secondary MCLs) for protection of drinking water
    f. Title 22 of the California Administrative Code, California Domestic Water Quality and Monitoring Regulations - specifies drinking water criteria
    g. Water Quality for Agriculture, Irrigation and Drainage Paper No. 29, Food and Agriculture Organization of the United Nations - agriculture water quality goals
    h. Agreement Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish and Wildlife

i. Agreement on Diversion of Water from the Feather River for agricultural production
j. California Department of Health Services, Draft Guidance for Fresh Water Beaches
k. California Office of Environmental Health Hazard Assessment action levels for contaminants
l. U.S. EPA Water Quality Criterion for the Protection of Human Health: Methylmercury

2. Initial Information Package - identifies and analyzes existing water quality information for the tributaries to Oroville Reservoir, Oroville Reservoir, Feather River downstream from the dam, and the Thermalito facilities (Forebay, Power Canal, and Afterbay)
3. State Water Resources Control Board Toxic Substances Monitoring Program database from 1978 to 1995 lists significant levels of mercury and other metals in suckers, catfish, and bass from the Feather River downstream from Oroville Dam and in the vicinity of Highway 99.
4. DWR report "Evaluation of toxic substances in fish, benthic organisms, and sediment in the State Water Project" in 1987 found mercury in fish from Oroville Reservoir at concentrations that exceed current criteria

Information Needed:

1. In addition to the data currently being conducted, additional physical, chemical, and biological data are needed for determination of compliance with water quality objectives and effects of the project on beneficial uses. These additional data are required for Water Quality Certification under Section 401 of the federal Clean Water Act.
   a. Tributaries - Additional data throughout the year under different hydrologic conditions to establish the quality of water flowing into the reservoir for evaluation of any effects to water quality from the project.
   b. Reservoir - Monitoring of additional sites throughout the reservoir to determine suitability for beneficial uses and effects from project and other uses in and around the reservoir.
   c. Feather River downstream from Oroville Dam - Beneficial uses of the Feather River downstream from Oroville Dam are affected by the water quality of releases from the reservoir, as well as other project features such as the Feather River Fish Hatchery. In addition, comparison of the river to baseline water quality conditions in the upstream tributaries will allow determination of any effects to water quality from the reservoir.
   d. Thermalito Forebay Power Canal, Forebay, and Afterbay - Water quality in the Thermalito Power Canal and Forebay is affected by diversions of water released from Oroville Dam and recreational activities, and subsequently affects water quality in the Afterbay. Thermalito Afterbay water quality is also affected by recreational uses, and releases from the Afterbay affect agricultural production and water quality in the Feather River.

e. Oroville Wildlife Area - The Oroville Wildlife Area supports numerous ponds likely hydraulically connected to the Feather River. Water quality in the Feather River, therefore, affects water quality in the wildlife area ponds, which are extensively used by wildlife and recreationists.

2. Information on effects to project waters from project and recreational facilities and use from Issues W4 and W5.
3. Information on contaminants in sediments and fish from Issue W6.
4. Information on effects to project waters from land management and watershed management activities from Issue W7.
5. Evaluate existing data, collect additional data where needed, and compare data to criteria and goals.

Level of Analysis:

Review existing information, collect additional data where needed, and evaluate information to determine project effects on physical, chemical, and biological components of water quality in project waters and waters affected by the project.

Issues Addressed by Issue Statement:

WE3 General concerns include all parameters of water quality as flow enters the project boundaries, passes through facility features, and discharges downstream. Direct and indirect effects of the project on aquatic ecosystem health, on recreational opportunity, and on domestic and agricultural supply will be considered;
WE10 Maintain or improve water quality to protect beneficial uses and meet or exceed State objectives;
WE24 Warm water release requirements for agricultural production;
WE25 Does the present temperature model have the ability to forecast average daily water temperatures, under present and future operational demands, in the low-flow channel and in the river from the Thermalito Afterbay outlet down to Verona;
WE30 Are dissolved oxygen levels in the Feather River from Thermalito Afterbay to Live Oak a problem during the spring, summer, and fall months;
WE31 How have turbidity levels been affected by project operation;
WE32 Thermalito Afterbay acts as a thermal retention basin for project water prior to delivery to water districts outside the project boundary. How do releases from this water body affect the stream temperature and dissolved oxygen content of Feather River receiving waters;
WE33 Relationship between hatchery and water quality;
WE40 Minimum level of draw-down effect on water temps;
WE46 Spawning habitat in tributaries as they relate to operations;
WE48 Macroinvertebrates as an indicator of water quality;
WE50 Conversion from lotic to lentic environment and accompanying changes in water quality;

WE53 Consider water quality downstream of Oroville facilities and the effect of low flows on dilution of contaminants entering the Feather River downstream;

F1 Effects of existing and future project operations (including power generation, water storage, ramping rates, and releases, pump-back, water levels, and water level fluctuations) during all water year types on the behavior (e.g., migration timing, microhabitat selection, vulnerability to predators), reproduction, survival and habitat of warm- and cold-water fish and other aquatic resources (e.g., macroinvertebrates), which include in project waters and tributaries within the project boundaries (Lake Oroville, Diversion Pool, Fish Barrier Pool, Forebay, Afterbay, Oroville Wildlife Area), and in project affected waters;

T1 Effects of project features, existing and future operations (including power generation, water storage and releases, ramping rates, pump-back, water levels and water level fluctuations) and maintenance on wildlife and wildlife habitat. Specific concerns include deer winter range, band-tailed pigeon winter habitat, designated emphasis and harvest species, wintering, brooding, and nesting waterfowl, and other wildlife use of project and project-affected waters;

F6 Effects of existing and future project operations on sediment deposition, erosion, and recruitment through the system (including downstream sediment supply) and associated changes in water quality on the quantity and quality of aquatic habitats within project affected waters;

FE36 Under existing conditions, does the diversity and abundance of benthic macroinvertebrates in the low-flow section and in the river downstream of Thermalito Afterbay suggest a healthy stream channel;

FE64 Effect of project on available upstream fishery habitat (Incorporate all project facilities);

FE83 Macroinvertebrates as an indicator of water quality.

Oroville Facilities Relicensing
Environmental Work Group
Preliminary Issue Sheet

W5. Effects of Recreation Features on Water Quality

Issue Statement: Effects of existing and future water-based recreation on water quality of project waters. Concerns include MTBE, oils and greases, fuel spills, floating gas tanks, floating septic systems, floating restrooms, houseboat gray water tanks (e.g., nutrients) and pump out facilities.

Resource Goals:

- Operate project related recreational facilities and activities to protect suitability of project waters for all beneficial uses. ~~minimize contamination of project waters.~~
- ~~Ensure suitability of project waters for contact recreation~~.

~~Protect project waters for all beneficial uses.~~

- Adequate facilities and measures for safe handling of sanitary and commercial wastes from residential or commercial developments adjacent to project waters.

(Insert Butte County resource goal related to MTBE)

Scope: Within the FERC project boundary and as appropriate outside of project boundary ~~for effects to project~~ waters

Existing Information:

1. Goals and criteria from W3.

2. Initial Information Package - identifies and analyzes existing water quality information, summarized in W3.

3. ~~3.~~ Initial Information Package – identifies existing recreational facilities and activities
4. Water contamination information from DPR/Kelley Ridge lawsuit

Information Needed:

1. ~~Completion of Department of Health Services Drinking Water Source Assessment and Protection Program checklist to d~~Determine possible project related recreation contamination sources and activities, and potential sources of contamination adjacent to project waters

2. ~~(project related contamination)~~ Project related activities ~~- waters - Monitoring for e~~Evaluation of any effects to water quality from project related recreational activities and facilities, including~~. Weekly and event-based (i.e., holiday weekends, recreation tournaments (e.g., bass tournaments)) water quality data collection during the recreation season from project waters. Target specific activities such as~~ marinas ~~operations~~, boat launch facilit~~i~~ies, campgrounds, floating campsites, ~~houseboats,~~ beach

areas ~~(e.g., North Forebay Recreation Area, Bedrock Recreation Area in Oroville), swimming areas~~, floating restrooms, houseboats and pumpout facilities, fishing areas ~~facilities (e.g., fish cleaning stations, heavy fishing areas such as the Afterbay Outlet)~~, and wave-wash induced erosion or turbidity from powerboats~~. Monthly or other appropriately timed (e.g., spills) monitoring of commercial and residential developments near project waters. Monitoring~~ Evaluation to include microbiological indicator organisms ~~(total and fecal coliform and enterococcus bacteria)~~, petroleum byproducts (e.g., hydrocarbons, MTBE, oil and grease), ~~pesticides,~~ and nutrients.

3. ~~(non~~Non-project related~~)~~ ~~Urban runoff~~ ~~-~~– Evaluation of non-project related activities that affect project waters, such as adjacent developments that contribute contaminants that may limit beneficial uses of project waters. ~~Monitor~~ Evaluation would include residential and commercial developments near project waters with potential to contribute contaminated runoff to project waters, including pesticides, petroleum products, pets, waterfowl, and other animal wastes, leachfield effluent, septic system discharges, and nutrients.

4. Proposed project related recreational facilities - ~~Evaluate appropriateness of existing and future~~ Evaluation of proposed project related recreational facilities and activities for potential effects to water quality that may affect beneficial uses. ~~to prevent contamination of project waters from recreational activities~~. ~~Activities may include visitor education programs and prohibitions. s~~Investigate ways ~~to discourage wildlife contamination of project waters (e.g., waterfowl contribution to coliform bacteria in beach areas).~~

5. ~~Information on proposed new recreational developments with potential to contaminate project waters.~~

~~6.~~ Review existing data, collect additional data where needed, and evaluate~~d~~ data in relation to criteria and objectives.

Level of Analysis:

Review existing data from project waters, recreational facilities, and adjacent sources of contaminants to project waters. Collect additional data, where needed, and evaluate to determine effects to project waters from recreational developments and adjacent developments.

Issues Addressed by Issue Statement:

WE6 Fuel use at marinas – Floating gas tanks and sewer tanks;
WE35 Water contamination at North Forebay related to swimming opportunities;
WE38 Floating septic tanks;
WE39 Effects of boating on MTBE;

WE42 Floating restrooms, houseboat gray water tanks and pump out facilities effects on water quality;
WE43 Sewage spills into Lake Oroville;
WE 44Fuel spills as a result of fluctuating lake levels;
WE45 Effect on water quality from boat maintenance and cleaning products -- “biodegradable”

Oroville Facilities Relicensing
Environmental Work Group
Preliminary Issue Sheet

W6. Metals and Toxins Accumulation in Sediments and Aquatic Food Chain

Issue Statement: Effect of existing and future project facilities and operations on sediment deposition and potential impoundment of metals and toxins, including the potential presence and uptake of methylmercury through the food chain. Lake Oroville, fed by tributaries that have a history of gold mining activity, has potential for accumulation of elemental mercury in its basin sediments.

Resource Goals:

♦ Minimize project effects, to the extent possible, upon bioaccumulation in the aquatic food chain of metals and other toxic contaminants.

Scope: Within the FERC project boundary and as appropriate outside of project boundary for project related effects.

Existing Information:

1. Goals and criteria from W3.

2. Initial Information Package - identifies and analyzes existing water quality information, summarized in W3.

3. State Water Resources Control Board Toxic Substances Monitoring Program database from 1978 to 1995 lists significant levels of mercury and other metals in suckers, catfish, and bass from the Feather River downstream from Oroville Dam and in the vicinity of Highway 99.

4. DWR report "Evaluation of toxic substances in fish, benthic organisms, and sediment in the State Water Project" in 1987 found mercury in fish from Oroville Reservoir at concentrations that exceed current criteria
5. PG&E Sediment pass through studies (additional info from USFWS)
6. USGS Mercury Accumulation on Yuba River

Information Needed:

1. Analysis of sport selected fish species organisms comprising the food chain in or using project waters for metals and organic contaminant concentrations. . Using a phased approach, if. If significant concentrations of metals or organic contaminants are found in fish in the reservoir and other organisms, then analyses would include 1) aquatic organisms comprising the food chain, such as aquatic macroinvertebrates, and sediments in the reservoir would be analyzed for the presence of metals and organic contaminants. 2) fish, other aquatic organisms, and sediments upstream from the reservoir to determine if levels of contaminants are

amplified due to the reservoir, and 3) fish, other aquatic organisms, and sediments in the Feather River downstream from the dam to determine downstream effects of the project.

2. As appropriate, results from Geology, Soils, and Geomorphic Processes studies G1 and G4.

~~3.~~ 3. Analysis of data in comparison to established criteria.

Level of Analysis:

Review of available data for fish analyses, collect additional fish, other aquatic organism, and sediment samples where necessary, and evaluate potential project effects for metals and organic contaminants ~~in fish~~ in concentrations that exceed criteria. Comparison of results from fish in the reservoir with established criteria will determine the need for subsequent sampling and analyses of the reservoir food chain and sediments, tributaries, and downstream Feather River, and need for development of mitigation measures.

Issues Addressed by Issue Statement:

WE7	Lake Oroville, fed by tributaries that have a history of gold mining activity, has potential for accumulation of elemental mercury in its basin sediments. Potential presence and uptake of methylmercury through the food chain must be assessed;
WE13	Reduce sediment yields from watersheds in deteriorating conditions and those tributary to eroding channels or hazardous flood prone areas;
WE41	What coordination for Page 2 #5? -- Could be items along roads that might sweep into the river during floods;
G4	Project effects on sediment accumulation upstream of the dam;
F6	Effects of existing and future project operations on sediment deposition, erosion, and recruitment through the system (including downstream sediment supply) and associated changes in water quality on the quantity and quality of aquatic habitats within project affected waters.

Oroville Facilities Relicensing
Environmental Work Group
Preliminary Issue Sheet

W9. Thermal Regime of Project Waters

Issue Statement: Effects of existing and future project facilities and operations on thermal stratification and other thermal processes on project waters, including availability of cold water for release in various water year types under current and future operational demands.

Resource Goals:

- Minimize and mitigate adverse project effects on water temperatures needed to ~~support~~ protect beneficial uses.

- Maintain suitable water temperatures in waters affected by the project to ~~support~~ protect beneficial uses.

Scope: Within the FERC project boundary ~~downstream to the confluence with the Yuba River~~

Existing Information:

1. Goals and criteria
    - Water Quality Control Plan (Basin Plan) for the Central Valley designates beneficial uses and specifies water quality objectives
    - Agreement Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish and Wildlife
    - Agreement on Diversion of Water from the Feather River
2. Initial Information Package - identifies and analyzes existing temperature information, summarized in W3.
3. Project operations records (e.g., storage records, release rate, release depth, etc.).
4. NMFS Biological Opinion for temperature in the Feather River downstream from Oroville Dam

Information Needed:

1. Reservoir depth-capacity curve for determination of cold water pool.
2. Anticipated future operation of the project.
3. Model to predict:
    a. effects of Oroville Dam withdrawal elevation on release temperatures
    b. temperature of water released from the dam
    c. temperatures in the low flow section
    d. temperature at the hatchery

e. discharge temperatures from the Thermalito Afterbay
f. ~~f.~~ temperatures downstream from the Thermalito Afterbay ~~at intervals to the Yuba River~~within the project boundary
g. Effect of pumpback operations on reservoir temperatures

4. ~~4.~~ Additional temperature data for confirmation and calibration of model.
5. Evaluation of model output to determine the effects of project on thermal processes within the Project boundary.

Level of Analysis:

Analysis will rely on development of temperature model, use of existing data and collection of additional data for model validation, and evaluation of model output to determine project effects on thermal processes in relation to criteria.

Issues Addressed by Issue Statement:

WE16 Depth and capacity of the Oroville reservoir creates a thermally stratified condition. What is the cold-water pool retained in the basin and what is its availability for release in various water year types;

WE19 Is the availability of a cold-water pool in Lake Oroville adequate under present and future operational demands to meet the existing downstream cold fresh-water habitat requirements of steelhead and fall, late-fall, and spring-run Chinook salmon;

WE25 Does the present temperature model have the ability to forecast average daily water temperatures, under present and future operational demands, in the low-flow channel and in the river from the Thermalito Afterbay outlet down to Verona;

WE32 Thermalito Afterbay acts as a thermal retention basin for project water prior to delivery to water districts outside the project boundary. How do releases from this water body affect the stream temperature and dissolved oxygen content of Feather River receiving waters;

G4 Project effects on sediment accumulation upstream of the dam;

F1 Effects of existing and future project operations (including power generation, water storage, ramping rates, and releases, pump-back, water levels, and water level fluctuations) during all water year types on the behavior (e.g., migration timing, microhabitat selection, vulnerability to predators), reproduction, survival and habitat of warm- and cold-water fish and other aquatic resources (e.g., macroinvertebrates), which include in project waters and tributaries within the project boundaries (Lake Oroville, Diversion Pool, Fish Barrier Pool, Forebay, Afterbay, Oroville Wildlife Area), and in project affected waters;

F3 Project effects on resident fish species (e.g., trout and other salmonids and warm-water fish) habitat quantity and quality (including instream flow, sediment, woody debris, water temperature, etc.,) and habitat for other aquatic species;

FE89 Impact of project structures and operations on water quality conditions necessary to sustain anadromous salmonids and their habitats.

Oroville Facilities Relicensing
Environmental Work Group
Preliminary Issue Sheet

W10. Project Effects on Water Temperatures Downstream from Oroville Dam

Issue Statement: Effects of existing and future water releases and operations on water temperatures in the Diversion Pool, Forebay, Afterbay, Oroville Wildlife Area, low-flow section of the river and downstream areas; at the hatchery; for agriculture; and the quality and availability of habitat for salmonids and other aquatic resources.

Resource Goals:

- Minimize and mitigate adverse project effects on water temperatures needed to ~~support~~ protect beneficial uses.

- Maintain suitable water temperatures in waters affected by the project to ~~support~~ protect beneficial uses.

Scope: Within the FERC boundary. The ~~S~~study scope could also extend downstream to the mouth of the Feather River for some elements of this issue. The specific downstream scope will be defined for each element in the Study Plan. ~~Within the FERC project boundary and the Feather River to the confluence with the Yuba~~ Sacramento River ~~(use W3 language) (provide justification data for scope to Work Group – summary of seasonal relationship and water year types of various tributaries and contributions to Sacramento River)~~

Existing Information:

1. Goals and criteria
   - Water Quality Control Plan (Basin Plan) for the Central Valley designates beneficial uses and specifies water quality objectives
   - Agreement Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish and Wildlife
   - Agreement on Diversion of Water from the Feather River
2. Initial Information Package - identifies and analyzes existing temperature information
3. Project operations records (e.g., storage records, release rate, release depth, etc.).
4. NMFS Biological Opinion for temperatures in the Feather River downstream from Oroville Dam

Information Needed:

1. ~~1.~~ Temperature profile data from the Diversion Pool, Forebay, Afterbay, and Oroville Wildlife Area ponds, and additional temperature recorders on the Feather River (e.g., at Verona) for confirmation and calibration of model.
2. ~~-~~Model to predict water temperatures in the:

a. reservoir
b. Diversion Pool
c. hatchery
d. Forebay
e. Afterbay
f. low flow section of the river
g. river downstream from the Afterbay Outlet to the ~~Yuba~~ Sacramento River

~~2.~~ 3. Reservoir depth-capacity curve for determination of cold water pool.
4.~~3.~~ Anticipated future operation of the project.
~~4. Temperature profile data from the Diversion Pool, Forebay, Afterbay, and Oroville Wildlife Area ponds, and additional temperature recorders on the Feather River (e.g., at Verona) for confirmation and calibration of model.~~
5. Evaluate model output to determine effects of the project on thermal processes downstream.

Level of Analysis:

Analysis will rely on development of temperature model, use of existing data and collection of additional data for model validation, and evaluation of model output to determine project effects on thermal processes in relation to criteria.

Issues Addressed by Issue Statement:

WE17 Water temperatures are an issue of concern for both aquatic resources and agricultural interests. Temperature monitoring is ongoing, and plans are to examine how specific water releases and operations will affect temperatures in the river, Afterbay, and hatchery;

WE19 Is the availability of a cold-water pool in Lake Oroville adequate under present and future operational demands to meet the existing downstream cold fresh-water habitat requirements of steelhead and fall, late-fall, and spring-run Chinook salmon;

WE25 Does the present temperature model have the ability to forecast average daily water temperatures, under present and future operational demands, in the low-flow channel and in the river from the Thermalito Afterbay outlet down to Verona;

WE28 Does the increase in river water temperature that results from warmer Thermalito Afterbay releases during the spring, summer, and fall months limit the amount of suitable steelhead and salmon habitat in the river downstream of Thermalito Afterbay;

WE29 Does the increase in river water temperature that results from warmer Thermalito Afterbay releases during the spring and early summer months affect survival of salmonid species outmigrating from the Feather and Yuba River;

WE32 Thermalito Afterbay acts as a thermal retention basin for project water prior to delivery to water districts outside the project boundary. How do releases from this water body affect the stream temperature and dissolved oxygen content of Feather River receiving waters;

WE40 Minimum level of draw-down effect on water temps;

WE46 Spawning habitat in tributaries as they relate to operations;

WE54 Impact of project structures and operations on water quality conditions necessary to sustain anadromous salmonids and their habitat. Adequacy of current project operating regimes and structures to optimize waterquality conditions for anadromous salmonids and their habitats;

F1 Effects of existing and future project operations (including power generation, water storage, ramping rates, and releases, pump-back, water levels, and water level fluctuations) during all water year types on the behavior (e.g., migration timing, microhabitat selection, vulnerability to predators), reproduction, survival and habitat of warm- and cold-water fish and other aquatic resources (e.g., macroinvertebrates), which include in project waters and tributaries within the project boundaries (Lake Oroville, Diversion Pool, Fish Barrier Pool, Forebay, Afterbay, Oroville Wildlife Area), and in project affected waters;

F10 Effect of existing and future project facilities and operations on anadromous fish habitat and populations (e.g., instream flows, water temperature, ramping rates, riparian habitat, large woody debris, predation, spawning gravels, stranding and desiccation, macroinvertebrate prey base, upstream and downstream passage, rearing conditions);

F11 Compliance of project operations with SWP Feather River Flow Constraints and adequacy of constraints to protect anadromous fish and other aquatic species in the low-flow section and in the river downstream of the Afterbay;

FE3 Is the present minimum pool adequate for protecting the Lake Orville cold-water sport fishery;

FE8 Lake Oroville releases made for power generation may cause dramatic fluctuations in lake level. What are the potential impacts of fluctuation zone and surface elevation change on recreation opportunities and on fish and wildlife habitat?

FE41 Early on and clearly identify flow rates and temperature requirements downstream of the dam;

FE46 Clearly identify species, landowners along river, flow rates and temperature requirements downstream of the dam;

FE49 Incidence of fish disease in response to temperature changes below dam;

FE52 Facility operations and impact – on bass fishery and spawning activities at afterbay (protect and enhance bass fishery);

FE56 The Feather River's low-flow reach has historically provided spawning habitat for a cold-water fishery. How have reduced flows to this stream reach affected water temperature and gravel substrate necessary for successful salmonid reproduction?

FE81 Currently some of the species of fish commonly found in Lake Oroville are also found in the Poe reach of the North Fork Feather River. Maximum water temperatures in the Poe reach often exceed 20 C (68 F), making management of the Poe reach as a coldwater fishery difficult. There is an interest in determining the interaction of the Lake Oroville fishery with the Poe reach fishery, and identifying measures that can be taken to maintain the Poe reach as a coldwater fishery;

FE85 Impact of project facilities and operations on fish passage includes structures, flows, and/or water quality conditions that impede or block passage within and from current and/or historic habitat and operations that impact passage or have the potential to enhance passage. Passage includes movement of spawning or holding adults, emigrating smolts, or movement of juveniles to different habitat areas for purposes of feeding, avoiding predators, or sheltering;

FE89 Impact of project structures and operations on water quality conditions necessary to sustain anadromous salmonids and their habitats;

FE90 Adequacy of current project operating regimes and structures to optimize water quality conditions for anadromous salmonids and their habitats;

FE95 The lower Feather River provides habitat to support a variety of anadromous fish species including Chinook salmon, steelhead, striped bass, American shad and sturgeon. Potential changes in license conditions could adversely impact habitat supporting these species. Habitat investigations should evaluate the existing quality and quantity of habitat and determine alternative improvements for the various life history needs of anadromous species including flow, water temperature, instream and riparian cover, substrate and spatial area;

FE96 The lower Feather River provides habitat to support a variety of resident native and resident introduced species including coldwater species such as rainbow, brook, and brown trout, and warm water species such as bass, catfish, bluegill, green sunfish, carp and others. Potential changes in license conditions could adversely impact habitat supporting these species or upset habitat conditions such that less desirable species are favored. Habitat investigations should evaluate the existing quality and quantity of habitat and determine alternative improvements for the various life history needs of these resident native and non-native species including flow, water temperature, instream and riparian cover, substrate and spatial area;

FE99 The Feather River Hatchery was constructed to mitigate for losses of upstream habitat when the Oroville facilities were constructed. There is a body of evidence suggesting that improperly planned hatchery practices can adversely impact native and non-native species including anadromous species. The effects of hatchery practices on naturally reproducing/self-sustaining anadromous populations should be examined as part of the fishery investigations. These evaluations should examine alternative practices that would lead to increased naturally reproducing/self-sustaining anadromous populations. Improper hatchery practices can also lead to transmission of serious fish diseases, and impact overall susceptibility of naturally reproducing populations to diseases.

Oroville Facilities Relicensing
Environmental Work Group
Preliminary Issue Sheet

W13. Hatchery Effects on Water Quality

Issue Statement: Effects of existing and future hatchery operations on water quality and water temperatures in the Feather River and Afterbay.

Resource Goals:
- Minimize effects of project related hatchery operations on water quality and temperature in project waters
- Ensure suitable water temperatures for salmonids in both the Feather River Hatchery and low flow section of the Feather River.
- Maintain suitable water quality for beneficial uses in the Feather River downstream from the hatchery.

Scope: Within the FERC project waters and the Feather River ~~to Honcut Creek~~downstream to limit of hatchery influence (Yuba River?).

Existing Information:

1. Goals and criteria from W3 and W10.

2. Initial Information Package - identifies and analyzes existing water quality and temperature information, summarized in W3.

3. Salmonid temperature preference studies and reviews, including U.C. Davis laboratory temperature preference study for steelhead trout.

4. ~~A m~~Mean monthly temperature model for the Feather ~~River has been developed, and a model based on one- hour increments is planned.~~

~~5.~~ 5. National Marine Fisheries Service temperature criteria for the Feather River low flow section.

6. NPDES permit for the Feather River Fish Hatchery and monitoring data~~?~~

4. List of chemicals used at the hatchery ~~Hatchery chemicals~~.

Information Needed:

1. Any proposed changes in hatchery operations, including discharge or waste disposal procedures, chemical useage, and hatchery temperature requirements.

~~2.~~ ~~2.~~ Water quality data including effluent constituents related to hatchery operations and the Feather River upstream and downstream from the hatchery, including groundwater or sub-surface flow from the hatchery waste treatment ponds ~~from W3~~.

3. Model for prediction of daily maximum, minimum, and mean water temperatures at the hatchery, low flow section of the Feather River, and Feather River downstream from the Afterbay Outlet as affected by initial temperatures in water released from Oroville Dam

3. ~~Continuous temperature recording~~ Temperature recorder data for water released to the Feather River from Oroville Dam, the Feather River low flow section, Fish Hatchery, ~~and the~~ Thermalito facilities (Forebay, Power Canal, and Afterbay), ~~Outlet, and temperature profiles for the Forebay and Afterbay~~ and ~~downstream on~~ the Feather River downstream from the Afterbay Outlet as necessary for model development and verification ~~(meteorological station data and temp profile data will be collected under W10).~~

~~4. Hourly~~ ~~Daily max/min~~ temperature ~~model~~ ~~data~~ ~~for the low flow section of the Feather River, Feather River Hatchery discharge, Feather River downstream from the Afterbay Outlet, Thermalito Power Canal, and Thermalito Afterbay Outlet.~~

~~5. Definitive temperature preference and tolerance for chinook salmon and steelhead trout in the Feather River. Review of temperature preferences pertinent to Feather River fish.~~

~~Temperature model based on one hour increments for effects to water temperatures in the Feather River from hatchery discharges and reservoir withdrawal level~~

6. Review existing information, collect additional information where needed, develop temperature model, and analyze~~d~~ data and model results to determine both beneficial and detrimental effects of project related hatchery operations on project waters, including a) effects to beneficial uses (e.g., agriculture, fisheries and other in-stream resources, etc.) of temperatures in water released from Oroville Dam to the Feather River for maintenance of water temperatures at the hatchery, b) effects to water temperatures in the Feather River from water discharged from the hatchery, c) effects of discharges from the Feather River Hatchery on water quality in the Feather River, and d) effects of water released from Oroville Dam for temperature maintenance at the hatchery on water quality in the Feather River.

~~Evaluate potential positive effects of hatchery operations on water quality downstream. Effluent constituents~~

Level of Analysis:

Review of temperature requirements and hatchery operations, temperature and water quality monitoring under various temporal and hydrologic conditions (i.e., water year types), and temperature model development and refinement.

Issues Addressed by Issue Statement:

WE26 How does the Feather River Hatchery requirement for warmer water in the summer impact river water temperatures required for holding or rearing of steelhead and spring-run chinook salmon in the low-flow section? That is, should the hatchery water come directly from Lake Oroville rather than from the river at the Fish Barrier Dam in order that both hatchery and river temperature needs can be satisfied;

WE33 Relationship between hatchery and water quality;

F1 Effects of existing and future project operations (including power generation, water storage, ramping rates, and releases, pump-back, water levels, and water level fluctuations) during all water year types on the behavior (e.g., migration timing, microhabitat selection, vulnerability to predators), reproduction, survival and habitat of warm- and cold-water fish and other aquatic resources (e.g., macroinvertebrates), which include in project waters and tributaries within the project boundaries (Lake Oroville, Diversion Pool, Fish Barrier Pool, Forebay, Afterbay, Oroville Wildlife Area), and in project affected waters:

F9 Hatchery effects (e.g., straying, genetic impacts, harvest rates, disease, temperature requirements, interactions with native fish such as predation and competition) on salmonid populations in the Feather River watershed and other Central Valley tributaries and on ecosystem restoration within project waters and project affected waters;

FE88 Impact of hatchery facilities and/or operations on anadromous salmonids. This includes the direct, indirect and cumulative impacts of hatchery product on anadromous salmonids and the direct, indirect and cumulative impacts of hatchery facilities and operations on salmonids and their habitats;

FE89 Impact of project structures and operations on water quality conditions necessary to sustain anadromous salmonids and their habitats;

FE90 Adequacy of current project operating regimes and structures to optimize water quality conditions for anadromous salmonids and their habitats;

FE95 The lower Feather River provides habitat to support a variety of anadromous fish species including Chinook salmon, steelhead, striped bass, American shad and sturgeon. Potential changes in license conditions could adversely impact habitat supporting these species. Habitat investigations should evaluate the existing quality and quantity of habitat and determine alternative improvements for the various life history needs of anadromous species including flow, water temperature, instream and riparian cover, substrate and spatial area;

FE96 The lower Feather River provides habitat to support a variety of resident native and resident introduced species including coldwater species such as rainbow, brook, and brown trout, and warm water species such as bass, catfish, bluegill, green sunfish, carp and others. Potential changes in license conditions could adversely impact habitat supporting these species or upset habitat conditions such that less desirable species are favored. Habitat investigations should evaluate the existing quality and quantity of habitat and determine alternative improvements for the various life history needs of these resident native and non-native species including flow, water temperature, instream and riparian cover, substrate and spatial area;

FE99 The Feather River Hatchery was constructed to mitigate for losses of upstream habitat when the Oroville facilities were constructed. There is a body of

evidence suggesting that improperly planned hatchery practices can adversely impact native and non-native species including anadromous species. The effects of hatchery practices on naturally reproducing/self-sustaining anadromous populations should be examined as part of the fishery investigations. These evaluations should examine alternative practices that would lead to increased naturally reproducing/self-sustaining anadromous populations. Improper hatchery practices can also lead to transmission of serious fish diseases, and impact overall susceptibility of naturally reproducing populations to diseases.

Oroville Facilities Relicensing
Environmental Work Group
Preliminary Issue Sheet

W17. Project Effects on Groundwater including hyporheic zone

Issue Statement: Effects of reservoirs and Feather River downstream of Oroville Dam on groundwater quality and quantity (e.g. hyporheic zone interaction).

~~(note: add definition of hyporheic)~~ (The "hyporheic zone" comprises the intersticies or spaces in the mixture of coarse sand, gravel, and rocks beneath and beside a river or stream. The spaces are permeated by flowing water in contact with that in the stream, and are inhabited by a variety of insects and other aquatic organisms)

Resource Goals:

- Minimize adverse project effects on groundwater movement, ~~groundwater~~ quality and ~~quantity~~level.

Scope: Within the FERC project boundary and adjacent to project boundary for project related effects.

Existing Information:

1. Goals and criteria from W3.

2. Initial Information Package - identifies and analyzes existing water quality information, summarized in W3.

3. Groundwater level and quality data from DWR

Information Needed:

1. Water quality data from project waters from W3.

2. ~~Gather~~ Evaluation of existing groundwater quality and level measurement data from the Oroville, Thermalito Forebay, Thermalito Afterbay, Oroville Wildlife Area, and Feather River areas, and surrounding areas

3. If existing data indicate potential adverse effect to groundwater, investigate and conduct additional groundwater data collection, including chemical analyses ~~or isotope data for water from Lake Oroville and Feather River~~ to determine source ~~in groundwater~~ and groundwater level measurements to develop quarterly groundwater level contour maps

4. ~~4.~~ Collate existing data, collect new data as needed, and analyze data to determine any adverse project effects to groundwater.
~~5. Quarterly groundwater level contour maps~~

Level of Analysis:

Review existing data, collect additional data as needed, and evaluate data to determine project effects to groundwater quality, quantity, and flow.

Issue Addressed by Issue Statement:

WE55 Effects of reservoirs and Feather River downstream of Oroville Dam on groundwater quality and quantity (e.g. hyporheic zone interaction).

Oroville Facilities Relicensing
Environmental Work Group
Preliminary Issue Sheet

T2. Project Effects on Special Status Plant and Animal Species

Issue Statement: Project effects on federal and State listed, species of concern, candidate, proposed, and likely threatened, endangered, sensitive, and special interest plant and animal species and the habitat needed to support them. Concerns include, but are not limited to, amphibians, bald eagle foraging habitat, wintering roosts, and nest territories.

Resource Goals:

- Minimize and mitigate adverse project effects on special status plant and animal species
- Promote the expansion of sensitive species

Scope: Within the FERC project boundary, ~~and downstream~~ the Feather River floodplain downstream to the confluence of the Yuba River, and other lands and habitats outside the boundary as appropriate, (consider adding explanation of why scope is appropriate)

Existing Information:

1. California Department of Fish and Game, Natural Diversity Database
2. Agency records (USFS, BLM, State Parks, DWR, CDFG)
3. Letter dated 12/10/99 to D. Russell, DWR from USFWS regarding federally endangered and threatened species list for Relicensing Studies, Butte, County.
4. California Native Plant Society, Inventory of Rare and Endangered Vascular Plants of California.
5. California Department of Fish and Game, Special Plants List, July 2000
6. California Department of Fish and Game, Guidelines for Assessing Effects of Proposed Developments on Rare Plants and Plant Communities
7. California Department of Fish and Game, Wildlife/Habitat Relationships Program
8. US Forest Service, Plumas National Forest, Sensitive and special interest plant and animal species.
9. US Forest Service, Sierra Nevada Forest Plan, Record of Decision, January 2001.
10. US Forest Service, Plumas National Forest, Rare Plant Handbook, August 1999.
11. Butte County Soil Survey, Soil Conservation Service
12. Scientific Literature

Information Needed:

1. Maps of soils within project boundary
2. Map of wildlife habitat and plant communities within project boundary produced in studies of Issue T4 (Biodiversity)
3. Literature review and analysis of special status species (ecology and habitats)
4. Identify potential special status species habitats using species information and wildlife habitat maps.
5. Survey for special status plant and animal species using established protocols (such as appropriate seasonal surveying) within the project boundary and ~~downstream~~ Feather River floodplain downstream to the confluence with the Yuba River and other lands and habitats outside the boundary as appropriate.
6. Evaluate potential project impacts on each special status species present within the project boundary and downstream Feather River floodplain to the confluence with the Yuba River

Level of Analysis: Literature review of each special status species and analysis of vegetation/habitat mapping to determine potential special status species habitats to be surveyed. Level of analyses will vary by species. State and federal threatened, endangered, and candidate species will be field surveyed using agency derived protocols. Other species of concern will be surveyed using standard methodologies. Desktop analysis of potential project impacts on each special status species and its habitat.

Issues Addressed by Issue Statement:

TE4 Provide suitable bald eagle foraging habitat along the North Fork upstream from Lake Oroville;
TE7 From January through August limit activities within active Bald Eagle nesting territories;
TE8 Between November 1 and March 31 limit activities within winter Bald Eagle roost habitat;
TE11 Encourage species recovery;
TE12 Develop plans for each Bald Eagle nesting territory; perform habitat improvement projects to enhance bald eagle nesting, roosting or foraging habitat;
TE13 Have adequate surveys been completed to determine what State or federally listed species (plant and animal) are potentially being impacted by project operations;
TE15 Inventory and monitor State and federal protected and sensitive plant and wildlife species;
TE16 Provide habitat leading to viable populations of endangered species;
TE17 Maintain habitat to support viable populations of all native and desired nonnative vertebrate species;

TE19 Provide diversity of plant and animal communities and tree species by assuring the continuous and viable presence of all seral stages of all native plant communities on the forest;

TE20 Provide a diversity of vegetation types and habitat to support viable populations of all fish, wildlife, and plant species;

TE21 Maintain and enhance the suitability of currently occupied nest territories, and provide sufficient potential nesting, foraging and winter habitat to meet recovery goals of the Pacific States Bald Eagle Recovery Plan;

TE22 At a minimum, provide habitat sufficient to maintain existing Bald Eagle populations;

TE25 Maintain viable populations of sensitive plant species. Protect sensitive and special interest plant species, as needed, to maintain viability;

TE38 Evaluate and mitigate bank swallow habitat impacts (threatened);

TE45 ESA compliance, want to hear about conflicts with folks and other species (bald eagles);

TE46 Improve terrestrial habitat with introduction of salmon (bears);

TE53 Biological Evaluation of species of concern from BLM and USFS (Plumas and Lassen NF) perspective Surveys should include Region 5 Sensitive plant and animal species as well as Plumas National Forest Special Interest plant species;

TE56 Adequacy of survey information to document the presence of state or federally listed plant or animal species that are potentially impacted by project operation;

TE57 Effects of reservoir surface elevation fluctuations on wildlife habitat;

TE59 Operate water levels in Thermalito Afterbay to prevent adverse impacts to Pacific Flyway waterfowl, especially during nesting in spring and early summer; continue to coordinate with DFG;

TE60 Evaluate effects of proposed increases in recreational activity in Thermalito Afterbay on waterfowl and other wildlife;

TE62 Protection and sustained conservation of terrestrial wildlife and flora in the project-affected area; comprehensive and well-crafted planning;

F13 Project effects on fish species listed for protection under the California and/or federal Endangered Species Acts (ESA), species of special concern, candidate species, proposed, and likely listed threatened and/or endangered fish species, and the habitat needed to support them.

Oroville Facilities Relicensing Project
Environmental Work Group
Preliminary Issue Sheet

T3. Project Effects on Floodplains and Water Fluctuation Zones

Issue Statement: Effects of existing and future project operations on floodplains and project water fluctuation zones, including soil stability, wildlife habitat and natural flood control functions, re-vegetation of native plant communities, and restoration opportunities (e.g., red willow planting).

Resource Goals:

- Minimize and mitigate adverse project-related effects on levee bound floodplain and soil stability, wildlife habitat, native plant communities and project water fluctuation.

- Enhance vegetation and wildlife habitat within the levee bound floodplain and project water fluctuation zone.

Scope:

Within the FERC project boundary and downstream Feather River levee bound floodplain to the confluence with the Yuba River.

Existing Information:

1. USDA – Natural Resource Conservation Service, Butte County Soil Survey
2. USGS 7.5 minute quadrangle maps
3. CSU Chico, Geographic Information Center, aerial mapping (Arcview GIS dataset) of stand-level riparian vegetation along the Feather River from the Oroville fish barrier to the Sacramento River.
4. Aerial photographs (current and historical)
5. Current DWR hydrological operations.

~~Transects available through flood modeling (ACOE, DWR Division of Flood Management, reference G???)~~Moved to Info needed

Information Needed:

1. Vegetation community and wildlife habitat maps produced from Issue T4 (Biodiversity)
2. Soils maps derived from the NRCS Butte County Soil Survey, including physical and chemical properties with erodibility factors
3. Land use maps within the project boundary and along the Feather River downstream to the Yuba River

4. Identification and delineation of ~~erodable or unstable areas~~channel stability factors produced in Issue G1~~ and G4~~ and G5.
5. Updated flood models for new flow regimes produced in Issue G2 (transferred to the Operations and Engineering Work Group).
~~5.~~6. Identify potential project impacts on riparian vegetation ~~in relation to the floodplain and water fluctuation zones~~using vegetation/flow relational models. ~~Could include vegetation/flow relational model.~~
~~6.~~7. Identify site specific areas and impacts to wildlife habitat (including bank swallow habitat) and native plant communities.
8. Evaluation of riparian vegetation within the fluctuation zone in relation to changes in project operations.

Level of Analysis: Desktop study to evaluate potential project effects on soil stability, wildlife habitat, native plant communities and natural flood control functions as delineated by soils ~~maps~~ maps, ~~and~~ vegetation/habitat mapping~~.~~, and ~~Additional~~ data from ~~other~~ geology and wildlife field investigations.

Issues Addressed by Issue Statement:

TE6	Re-vegetate disturbed areas within floodplains to stabilize soil, benefit fish and wildlife, and restore the natural flood control qualities;
TE29	Interaction of lake with wildlife species (birds, amphibians, etc.) – how is lake used;
TE34	Favor riparian dependent resources and limit disturbance in all riparian areas including riparian and aquatic ecosystems, wetlands, stream banks, and floodplains;
TE39	Manage flows and/or reservoir storage to maintain or enhance riparian plant communities and habitat for all life stages of fish. Cooperate with local, State, and other Federal water management agencies. Protect riparian areas while providing developed facilities;
TE40	Native plant landscaping (potential sites: Feather River fish Hatchery, State Parks Headquarters, DWR Field Office, Spillway Launch Facility - future) and restoration of native plant communities;
TE52	Evaluate quality of vernal pools in the project boundary and project operation on health/quality of pools;
TE56	Adequacy of survey information to document the presence of state or federally listed plant or animal species that are potentially impacted by project operation;
TE57	Effects of reservoir surface elevation fluctuations on wildlife habitat;
TE61	Project effects on downstream riparian habitat and the reservoir shoreline, including on-going effects of reservoir operations and recreational uses; effective stabilization, restoration and enhancement measures;
GE15	Avoid water quality degradation by using Best Management Practices during land management activities, and reduce sedimentation and channel erosion by rehabilitating deteriorating watersheds;

GE17 Reduce sediment yields from watersheds in deteriorating conditions and those tributary to eroding channels or hazardous flood prone areas;

GE18 Re-vegetate disturbed areas within the floodplains to stabilize soil, benefit fish and wildlife, and restore the natural flood control qualities;

G1 Effects of existing and future project operations on natural geomorphic processes. These include physical attributes and functions (e.g., channel morphology, channel stability, sediment transport and deposition, spawning gravel and large woody debris recruitment, habitat diversity) and subsequent effects on biological resources (e.g., aquatic macroinvertebrates, riparian vegetation) in the low-flow section and in the Feather River downstream of Thermalito Afterbay under wet and dry year criteria;

F13 Project effects on fish species listed for protection under the California and/or federal Endangered Species Acts (ESA), species of special concern, candidate species, proposed, and likely listed threatened and/or endangered fish species, and the habitat needed to support them;

W7 Effect of existing and future project-related land management and watershed management activities (including waste disposal and pesticide use) on water quality, slope stability, erosion, sedimentation, channel stability, riparian habitat, fish habitat, and other beneficial uses.

Oroville Facilities Relicensing
Environmental Work Group
Preliminary Issue Sheet

T 6. Interagency Wildlife Management Coordination

Issue Statement: Interagency management coordination, adequacy of management plans and activities and funding for wildlife management

Resource Goal:

- Development of coordinated interagency wildlife management plan(s) for lands within the project boundary which promote wildlife species diversity, population of sensitive wildlife species, and recreationally/commercially important species.

Scope: Within the FERC project boundary

Existing Information:

1. Land/resource management plans, policies, direction for California Department of Water Resources, California Department of Parks and Recreation, U.S. Forest Service (Plumas National Forest Land Management Plan), U.S. Bureau of Land Management, Butte County (General Plan), and California Department of Fish and Game (Wildlife Area Management Plan 1978).
2. Current funding levels for wildlife management.
3. Previous agreements/management coordination related to the Oroville Wildlife Area

Information Needed:

1. Identification of current level of wildlife management coordination
2. DWR/DFG management evaluation of the purpose and funding related to the Oroville Wildlife Area
3. ~~Previous agreements/management coordination related to the Oroville Wildlife Area~~
4. Development of a coordinated Terrestrial Resource Management Plan for lands within the FERC project boundary

Level of Analysis: Interagency coordination and desktop study leading to development of a Terrestrial Resource Management Plan

Issues Addressed by Issue Statement:

TE10 Continue cooperation allowing the CDPR to manage the reservoir area including Plumas National Forest lands;

TE26 Are additional funds needed to augment the existing budget of the Oroville Wildlife Area? Presently available Fish and Game funds are being dedicated to managing people and not wildlife habitat;

TE32 DWR and DFG to work cooperatively to preserve hunting and fishing opportunities in the afterbay and borrow areas, and Lake Oroville;

TE39 Manage flows and/or reservoir storage to maintain or enhance riparian plant communities and habitat for all life stages of fish. Cooperate with local, State, and other Federal water management agencies. Protect riparian areas while providing developed facilities;

TE44b trespass, grazing leases, acquisition of additional land within the project boundary for wildlife management;

TE49 Responsible management by resource agencies;

TE54 Evaluation of funding adequacy for Oroville Wildlife Area;

TE55 Evaluation of funding adequacy for law enforcement;

G3 The need to coordinate long-range watershed planning activities with local, state and federal agencies and private landowners;

F5 Effects of existing and proposed fisheries management plan(s) and activities on a balanced cold- and warm-water fishery (including stocking levels, hatchery management and production relative to in-river populations, habitat enhancement projects, predator and undesirable species control, and prevention of future introductions (e.g., Northern pike, striped bass, etc.), disease, tree stakes and tire removal, and harvest).

Oroville Facilities Relicensing
Environmental Work Group
Preliminary Issue Sheet

T8. Project Effects on Undesirable Non-native Wildlife

Issue Statement: Effects of existing and future operations of project on the introduction, distribution and management of undesirable non-native wildlife species.

Resource Goal:

- Minimize and mitigate project-related effects on native wildlife by undesirable non-native wildlife species

Scope: Within the FERC project boundary and downstream Feather River levee bound floodplain to the confluence with the Yuba River, and other lands outside the boundary as appropriate.

Existing Information:

1. California Wildlife/Habitat Relationships Program (Version 7)
2. List of non-native wildlife found within the project area
3. Habitat preferences of introduced wildlife species
4. Scientific Literature
5. DFG Integrated Biological Information System (IBIS) Program

Information Needed:

1. List of undesirable non-native wildlife
~~1.~~2. Agency records (USFS, BLM, State Parks, DWR, CDF&G)
~~2.~~3. Trapping/animal control records
~~3.~~4. Identification of grazed lands
~~4.~~5. Map of wildlife habitat and plant communities within the project boundary produced in studies of Issue T4 (biodiversity).
~~5.~~6. Evaluation of potential project impacts on each non-native wildlife species present

Level of Analysis: ~~-~~Desktop study to evaluate potential project-related effects on the introduction and distribution of undesirable, non-native wildlife and their impact on native wildlife.

Issues Addressed by Issue Statement:

~~TE30b There is an interest in determining locations of noxious weeds within and adjacent to the project area and determining control and eradication~~

~~measures as needed. Inventory plants located on National Forest system lands within and adjacent to project facilities as well as the perimeter of Lake Oroville. Survey for California Department of Food and Agriculture Category A, B and C noxious weeds;~~

TE30a Inventory and map alien plant and animal species

TE47 Continue inventory of plant and animal species in the project area.

Oroville Facilities Relicensing
Environmental Work Group
Preliminary Issue Sheet

T10. Project Effects on Upland Habitat, Revegetation, and Restoration

Issue Statement: Effects of current and future project features, operations, and maintenance on upland habitat (including brood ponds), revegetation and restoration.

Resource Goal:

- Minimize and mitigate project-related effects on upland habitat
- Enhance upland habitat on project lands

Scope:

Within the FERC project boundary and a buffer zone, as appropriate. ~~and as appropriate outside of project boundary for project-related effects.~~

Existing Information:

1. DWR operation data including DWR hydrology records with project inflow and outflow, water levels and ramping rates.
2. DWR, USFS, BLM, DFG and DPR management activities
3. California Waterfowl Association, DWR and CDFG brood pond management, mapping and creation information. Upland nesting habitat information (see Don)
4. Other appropriate agencies (ie Caltrans) Butte County Ag Commissioners' monthly reports (880)

Information Needed:

1. List and location of existing and currently proposed project facilities and associated activities.
2. Wildlife habitat/plant community maps produced in studies of Issue T4 (biodiversity).
3. List of proposed new facilities and/or changes in project operations.
4. Assessment of existing and new information to determine potential-related effect on upland habitat

Level of Analysis: Desktop analysis to determine project impacts on ~~native~~ wildlife and plant communities.

Issues Addressed by Issue Statement:

TE59 Operate water levels in Thermalito Afterbay to prevent adverse impacts to Pacific Flyway waterfowl, especially during nesting in spring and early summer; continue to coordinate with DFG;

TE62 Protection and sustained conservation of terrestrial wildlife and flora in the project-affected area; comprehensive and well-crafted planning;

TE63 Effects of existing and future project features, operations and maintenance on upland habitat, including, revegetation and restoration efforts;

G3 The need to coordinate long-range watershed planning activities with local, state and federal agencies and private landowners;

W7 Effect of existing and future project-related land management and watershed management activities (including waste disposal and pesticide use) on water quality, slope stability, erosion, sedimentation, channel stability, riparian habitat, fish habitat, and other beneficial uses.

Oroville Facilities Relicensing
Environmental Work Group
Preliminary Issue Sheet

T11. Fire Prevention/Fuel Load Control

Issue Statement: Effects of fire prevention/fuel load control on natural communities

Resource Goal:

- Identify fire prevention management practices to help reduce damage from fires to natural and man-made resources and enhance habitat diversity.
- Minimize negative impacts to wildlife habitat through fire and fuel load management practices to enhance public safety (sensitive to wildlife habitat)

Scope: Within the FERC project boundary

Existing Information:

1. California Fire Plan (California Department of Forestry)
2. California Vegetation Management Plans (VMP) and Incident Action Plans (California Department of Forestry)
3. US Forest Service, Plumas National Forest, fire management plan
4. Federal Wildfire Management Policy, 1995
5. Butte County Fire Safe Council
6. Oroville Fire Safe Council
7. Quincy Library Group Federal Wildfire Policy Review (January 1995)
8. CDF controlled burn records/fuel loading data
9. DWR fuelbreak location and maintenance data
10. State and federal fire atlas
11. Scientific literature

Information Needed:

1. Vegetation community and wildlife habitat maps produced from studies in Issue T4 (biodiversity).
2. Land-use maps within the project boundary
3. Evaluation of current and potential land use/management practices
4. Identify various fire management strategies from VMPs.

Level of Analysis:

Desktop study to identify risk and consequences of various management strategies (e.g. fire use versus fire exclusion) within the project area.

Issue Addressed by Issue Statement:

TE33 Fuel load on state lands – potential impact to habitat (wildlife and human);
TE64 Effects of existing and future fire prevention/fuel load control on natural communities.

Oroville Facilities Relicensing
Environmental Work Group
Preliminary Issue Sheet

G4. Project Effects on Sediment Movement and Deposition Upstream of Oroville Dam

Issue Statement: Project effects on sediment accumulation upstream of the dam.

Resource Goals:

- Minimize and mitigate adverse project impacts of sediment deposition in Lake Oroville on fisheries resources and water quality.

- Reduce the rate and amount of sediment depositing in Lake Oroville

Scope: Within the FERC project boundary upstream of Oroville Dam

Existing Information:

1. Watershed conditions, including erosion, landsliding, and sediment production from the North, Middle, and South forks of the Feather River upstream from Lake Oroville were estimated in a Department of Water Resources-Northern District memorandum dated 1994.
2. Lake Oroville sedimentation was measured using lake transects by DWR_ND. Results were reported in the " 1993-1994 Lake Oroville Siltation Study". The report provided information on the sediment production of the upstream watersheds, information required to estimate sediment losses to the downstream ecosystem.
3. See Issue Sheet G-1 for complete listing.
4. PG&E sediment (pass through) studies on Rock Creek and Poe
5. PG&E Divestiture EIS/EIR

Information Needed:

1. Physical Data- Bank erosion locations, bathimetry or surveys of deposits in the major tributaries, areas prone to landslides, historic channel changes, historic photographs, cross-sections, and old survey maps showing pre- and post dam conditions within Lake Oroville ~~and the Thermalito Afterbay~~.

~~2.~~Develop Process Rates- Develop geomorphic process rates for reservoir bank erosion, sediment deposition, and reworking.

2. ~~Index of Hydrologic Alteration (IHA) analysis.~~
3. Analyze data to reevaluate sedimentation rates based on the incursion of sediment during the 1997 flood and with the proposed re-operation of PG&E reservoirs in the upper watershed.

4. Evaluate the effects of existing and future project operations, including seasonal and annual variation in water storage and lake level fluctuations and reservoir flow release rates, on physical processes affecting sediment scour, erosion, and deposition rates within Lake Oroville.

Level of Analysis:

Literature review of existing reports and data for sediment production in the watershed above Lake Oroville and deposition within the lake, and identification of shoreline areas with geologic conditions that would indicate high erosion potential.

Field work to include land and bathimetric surveying of sediment deposits in the arms of the major tributaries during expected low water conditions, evaluation of the shoreline soils and geology to identify sites prone to high erosion rates.

Issues Addressed by Issue Statement:

GE19 Gravel recruitment impacts of the dam – both up and down stream;
GE22 Effect of accumulated sediment on lake bathymetry of Lake Oroville;
W6 Effect of existing and future project facilities and operations on sediment deposition and potential impoundment of metals and toxins, including the potential presence and uptake of methyl mercury through the food chain. Lake Oroville, fed by tributaries that have a history of gold mining activity, has potential for accumulation of elemental mercury in its basin sediments;
W9 Effects of existing and future project facilities and operations on thermal stratification and other thermal processes on project waters, including availability of cold water for release in various water year types under current and future operational demands.

Oroville Facilities Relicensing
Environmental Work Group
Preliminary Issue Sheet

G5. Effect of the Project Related Hydrologic Changes on Stream Geomorphology

Issue Statement: Effect of the project including discharge (magnitude, frequency, and timing) and ramping rates and the altered stream hydrology on substrate scour, mobilization of sediments, turbidity levels, and riparian vegetation in the low flow reach and downstream of the afterbay.

Resource Goals:

- Minimize and mitigate adverse project impacts resulting from altered flow regimes.
- Return as far as is practicable to natural sedimentation and scour regime in the river below the dam.

Scope: Within the FERC project boundary on the Feather River downstream of Lake Oroville to the confluence with the Yuba River~~. (I'm including the reach affected by the spillway for this issue)~~

Existing Information:

1. See Issue Sheet G-1
2. Feather River downstream from Oroville Dam is monitored continuously at a number of gaging stations, providing hydrologic date necessary to estimate pre- and post dam hydraulic changes. The data are available from the California Data Exchange Center.
3. The U.S. Geological Survey published "Sediment Transport in the Feather River, Lake Oroville to Yuba City, California" provides information prior to 1967 on sediment transport, hydrology, hydraulic geometry, and other channel characteristics. This report will be useful in determining changes between the completion of Lake Oroville and the present

Information Needed:

1. Physical Data- Bank erosion locations, historic channel changes, historic photographs, cross-sections, and old survey maps showing pre- and post dam conditions, including channel width, cross-sectional area, vegetation, channel roughness, gradient, depth, and etc.
2. Results of the flow modeling including magnitude and duration of flows, flow velocities etc. ~~(using E&O Issue Sheet related to flow modeling)~~These results will come from the modeling covered by Issue Statement E4.

3. Develop Process Rates- Develop geomorphic process rates for bank erosion, sedimentation, sediment routing, spawning gravel and bedload movement.
4. ~~4.~~ Conduct flow release studies to determine the relationship between flow and ~~for~~ specific channel-forming and sediment transport ~~purposes~~processes.
5. Index of Hydrologic Alteration (IHA) analysis.
6. Evaluation of existing and additional information collected to determine project-related effects.
7. Evaluation of past efforts to supplement gravels (existing data)

Level of Analysis:

~~Literature review~~Desktop study including literature review of existing reports and data sets to establish the pre-existing and current conditions

Perform field work including bank erosion, sediment transport, and other monitoring activities throughout the year and under different hydrologic conditions as they occur during the study period in project waters. Conduct surveys to measure gravel size, bed scour, and sediment deposition during and after high flow releases.

Issues Addressed by Issue Statement:

GE2 Project features and operations alter the hydrology of the system, creating the possibility for scour zones within both natural and designed channels. What effects do discharge and ramping rates have on substrate scour and the mobilization of sediments into the water column downstream?

GE7 (add text as appropriate)